CLAIMS

1. A method for determining parameter values for adjusting an image, the method comprising:

   specifying a first function of a local attribute based on values of the local attribute in the image;

   specifying a second function of the local attribute based on an image adjustment depending upon an adjustment parameter;

   calculating an object function value for each of two or more values of the adjustment parameter, each object function value including accumulated differences between the first and second function at a plurality of values of the local attribute; and

   based on the calculated object function values, determining a value of the adjustment parameter for adjusting the image.

2. The method of claim 1, wherein:

   specifying the first function of the local attribute includes specifying the first function based on modified values of the local attribute generated by another image adjustment when applied to the image.

3. The method of claim 1, wherein:

   specifying the first function of the local attribute includes specifying the first function based on a cumulative distribution of the values of the local attribute in the image.

4. The method of claim 3, further comprising:

   specifying the cumulative distribution based on a density histogram generated by binning values of the local attribute in the image into predetermined intervals.

5. The method of claim 3, wherein:

   the cumulative distribution is a contrast-constrained cumulative distribution.

6. The method of claim 1, wherein:

   specifying the second function of the local attribute includes specifying an attribute mapping for the local attribute based on the image adjustment, the attribute mapping depending on the adjustment parameter.

7. The method of claim 6, wherein the attribute mapping is specified by a non-local function depending, for each location within the image, on a neighborhood intensity characterizing pixel values in a neighborhood surrounding the location.

8. The method of claim 7, wherein:

   specifying the second function of the local attribute includes, for each location within the image, substituting the corresponding neighborhood intensity with a pixel value at the location.

9. The method of claim 6, wherein:

   specifying the second function of the local attribute includes specifying a composite function of the local attribute based on the attribute mapping and a non-linear function defining a desired distribution for the local attribute.

10. The method of claim 9, wherein the desired distribution corresponds to a gaussian density of the local attribute.

11. The method of claim 1, wherein calculating the object function values includes:

    accumulating differences between a center value of the local attribute and values of the second function at the plurality of values of the local attribute; and

    combining the accumulated differences between the first and second functions with the accumulated differences between the center value and the second function.

12. The method of claim 1, wherein:

    calculating the object function values includes accumulating differences between the first and second function according to a functional weight that depends on the value of the local attribute.

13. The method of claim 1, wherein:

calculating the object function values includes accumulating squared differences between the first and second function at the plurality of values of the local attribute.

14. The method of claim 1, wherein:

determining the value of the adjustment parameter for adjusting the image includes finding an adjustment parameter value for which the object function value is minimal.

15. The method of claim 1, further comprising:

adjusting the image using the image adjustment with the determined value of the adjustment parameter.

16. The method of claim 1, wherein the local attribute depends on luminosity.

17. The method of claim 1, wherein the local attribute depends on a color value.

18. The method of claim 1, wherein the image adjustment includes separate tone adjustments for different tones.

19. The method of claim 18, wherein the tone adjustments include a shadow adjustment and a highlight adjustment.

20. A software product, tangibly embodied in a machine-readable medium, for determining parameter values for adjusting an image, the software product comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

specifying a first function of a local attribute based on values of the local attribute in the image;

specifying a second function of the local attribute based on an image adjustment depending upon an adjustment parameter;

calculating an object function value for each of two or more values of the adjustment parameter, each object function value including accumulated differences between the first and second function at a plurality of values of the local attribute; and

based on the calculated object function values, determining a value of the adjustment parameter for adjusting the image.

21. The software product of claim 20, wherein:

specifying the first function of the local attribute includes specifying the first function based on modified values of the local attribute generated by another image adjustment when applied to the image.

22. The software product of claim 20, wherein:

specifying the first function of the local attribute includes specifying the first function based on a cumulative distribution of the values of the local attribute in the image.

23. The software product of claim 22, further comprising instructions operable to cause one or more data processing apparatus to perform operations comprising:

specifying the cumulative distribution based on a density histogram generated by binning values of the local attribute in the image into predetermined intervals.

24. The software product of claim 22, wherein:

the cumulative distribution is a contrast-constrained cumulative distribution.

25. The software product of claim 20, wherein:

specifying the second function of the local attribute includes specifying an attribute mapping for the local attribute based on the image adjustment, the attribute mapping depending on the adjustment parameter.

26. The software product of claim 25, wherein the attribute mapping is specified by a non-local function depending, for each location within the image, on a neighborhood intensity characterizing pixel values in a neighborhood surrounding the location.

27. The software product of claim 26, wherein:

specifying the second function of the local attribute includes, for each location within the image, substituting the corresponding neighborhood intensity with a pixel value at the location.

28. The software product of claim 25, wherein:

specifying the second function of the local attribute includes specifying a composite function of the local attribute based on the attribute mapping and a non-linear function defining a desired distribution for the local attribute.

29. The software product of claim 28, wherein the desired distribution corresponds to a gaussian density of the local attribute.

30. The software product of claim 20, wherein calculating the object function values includes:

accumulating differences between a center value of the local attribute and values of the second function at the plurality of values of the local attribute; and

combining the accumulated differences between the first and second functions with the accumulated differences between the center value and the second function.

31. The software product of claim 20, wherein:

calculating the object function values includes accumulating differences between the first and second function according to a functional weight that depends on the value of the local attribute.

32. The software product of claim 20, wherein:

calculating the object function values includes accumulating squared differences between the first and second function at the plurality of values of the local attribute.

33. The software product of claim 20, wherein:

determining the value of the adjustment parameter for adjusting the image includes finding an adjustment parameter value for which the object function value is minimal.

34. The software product of claim 20, further comprising:

adjusting the image using the image adjustment with the determined value of the adjustment parameter.

35. The software product of claim 20, wherein the local attribute depends on luminosity.

36. The software product of claim 20, wherein the local attribute depends on a color value.

37. The software product of claim 20, wherein the image adjustment includes separate tone adjustments for different tones.

38. The software product of claim 37, wherein the tone adjustments include a shadow adjustment and a highlight adjustment.